1166

ELECTRONIC MANOMETER

Datametrics

A subsidiary of **ITE Imperial** CORPORATION

Fordham Road, Wilmington, Mass. 01887 • (617) 658-5410

MP MASTER

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340 Fordham Road, Wilmington, Mass. 01887

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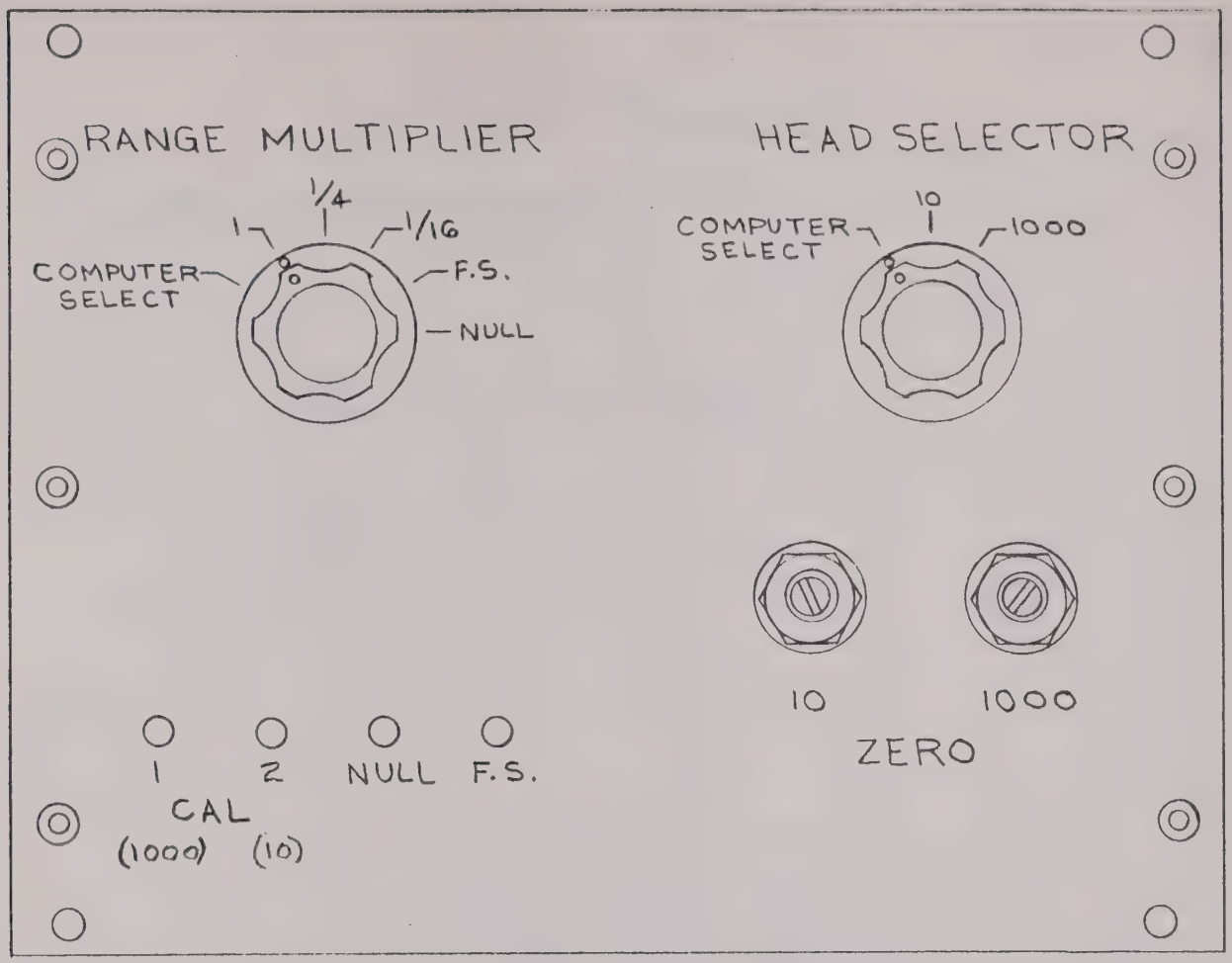
SECTION I - INTRODUCTION

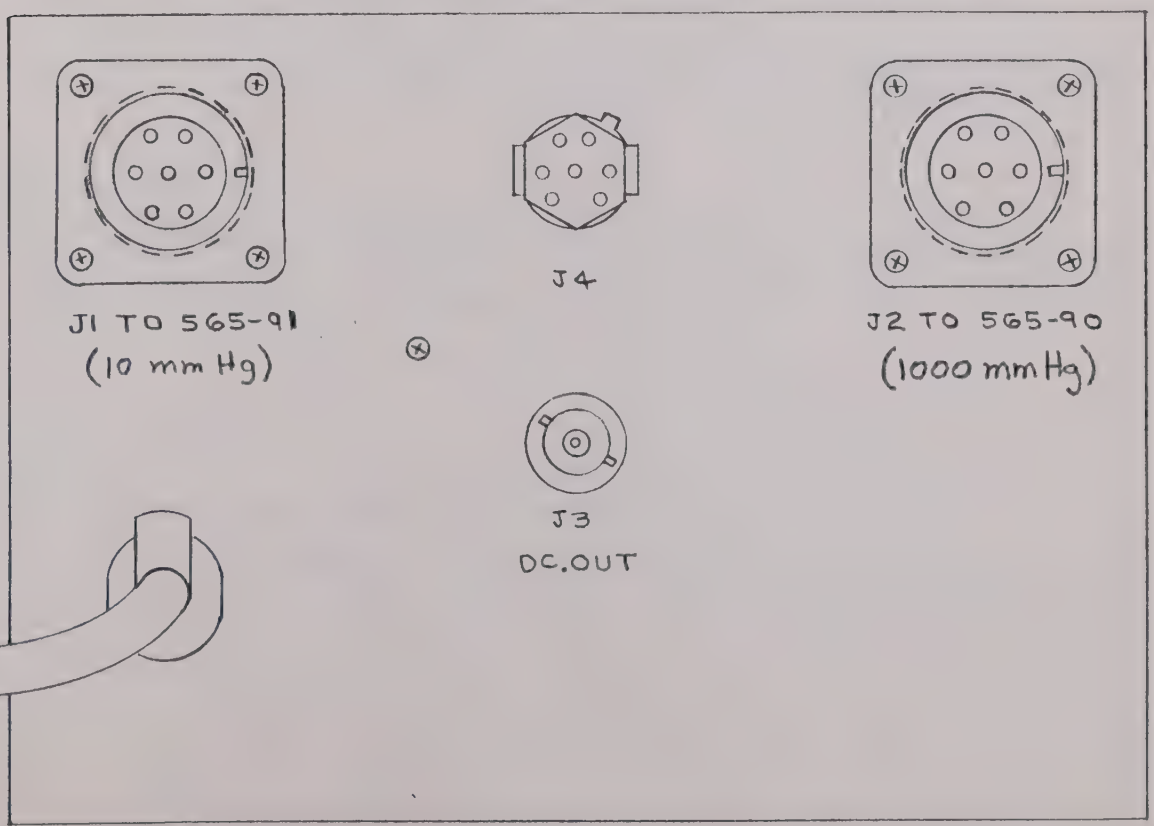
GENERAL DESCRIPTION

The Model 1166 Barocel Electronic Manometer is a high-precision, wide range pressure transducing and measuring system. Used with two pressure sensors, the system is capable of measuring gage, differential, or absolute pressures ranging from 10^{-5} to 5 x 10mm Hg. Due to the inherent stability and linearity of the system a 10^{4} to one range in pressure can be covered. The latest solid state integrated circuit techniques are utilized to provide high reliability and long term accuracy. The unit can be remotely switched to one of the two sensors and one of four ranges.

Electronic circuits condition the signals so as to scale the readout in a system of units compatible with the pressure sensor. This analog voltage proportional to pressure is available for external use, such as recording, control, or automatic data acquisition. Zero and FULL SCALE check are available to the user via front panel switch functions.



1166 FRONT AND REAR PANEL



SECTION II - SPECIFICATIONS

1166 POWER SUPPLY AND SIGNAL CONDITIONER WITH TYPE 565 HEADS (MICROMERITICS TYPE 2500 SYSTEM)

Pressure Ranges

1. Head #1: Scale A - 0 to 1000.0 torr
   Scale B - 0 to 250.0 torr
   Scale C - 0 to 62.5 torr

2. Head #2: Scale A - 0 to 10 torr
   Scale B - 0 to 2.5 torr
   Scale C - 0 to .625 torr

3. Over Pressure: 25 psi, no damage

Accuracy

(At 34° ±0.25°C)

1. Head #1: (a) Better than 0.1% of reading ±0.1 torr.

   (b) Incremental Accuracy: better than 0.2 torr per 100 torr in the range from 0 to 800 torr; better than 0.25 torr from 800 to 900 torr; better than 0.4 torr from 900 to 1000 torr.

2. Head #2: (a) Better than 0.3% or reading ±0.002 torr.

   (b) Incremental Accuracy: better than 0.120 torr per 1 torr increment from 0 to 40 torr.

Zero Stability

(At 34° ±0.25°C, zero differential pressure at ambient pressure)

1. Head #1: less than 1 torr in 30 days.

2. Head #2: less than 0.01 torr in 30 days.

Leakage (At 34°C)

Side to side: less than 3×10^{-7} cc/minute.

Each inlet to atmosphere: less than 1×10^{-10} std cc/second.

Outgassing

Less than 0.2 microns per minute after 24 hours at 34°C (P_1 inlet).

Power Input

100 to 130 VAC, 50 to 400 Hz, single phase, 25 watts maximum.

Noise

Less than 0.25 millivolt, peak to peak on all scales.

Front Panel Controls

1. HEAD SELECTOR Switch: Computer Select, 10, 1000 (torr)
2. RANGE MULTIPLIER Switch: Computor Select 1, 1/4, 1/16, F.S., NULL
3. ZERO: One for each Head, screwdriver adjust having coarse and fine on one shaft.
4. CAL: one for each sensor, 22-turn screwdriver adjust
5. NULL: enable zeroing signal conditioner circuitry

Interchangeability

All sensors and readouts to be field interchangeable.

Sensor Self-Calibration

Head #1 and Head #2 to contain pushbutton switch to produce a calibration output for system check and set-up of CAL pot on indicator

Output

0 to ±1 volts DC, proportional to pressure.

Cable: 1074 cable standard between barocel and manometer.

Interface Connector (Rear Panel) J4:

Provides electrical connection between unit and computer interface.

SECTION III - OPERATING INFORMATION

INSTALLATION

Connect the barocels to the Manometer as shown in the connection diagram. Connect pressure lines to barocels as outlined in Section VIII.

OPERATING CONTROLS DESCRIPTION

RANGE MULTIPLIER Switch (Front Panel)

The multiplier enables the operator to adjust the sensitivity of the system so that for a given input pressure, the output will be as large as possible. This results in a meter reading sufficiently up-scale to enable the greatest possible accuracy.

The NULL position allows the user to check the amplifier zero. This should not require adjustment, it should be adjusted only after the unit is properly connected.

The F.S. position allows the user to check the operation of the electronic circuitry. Normally, this adjustment will not be necessary.

HEAD SELECTOR Switch (Front Panel)

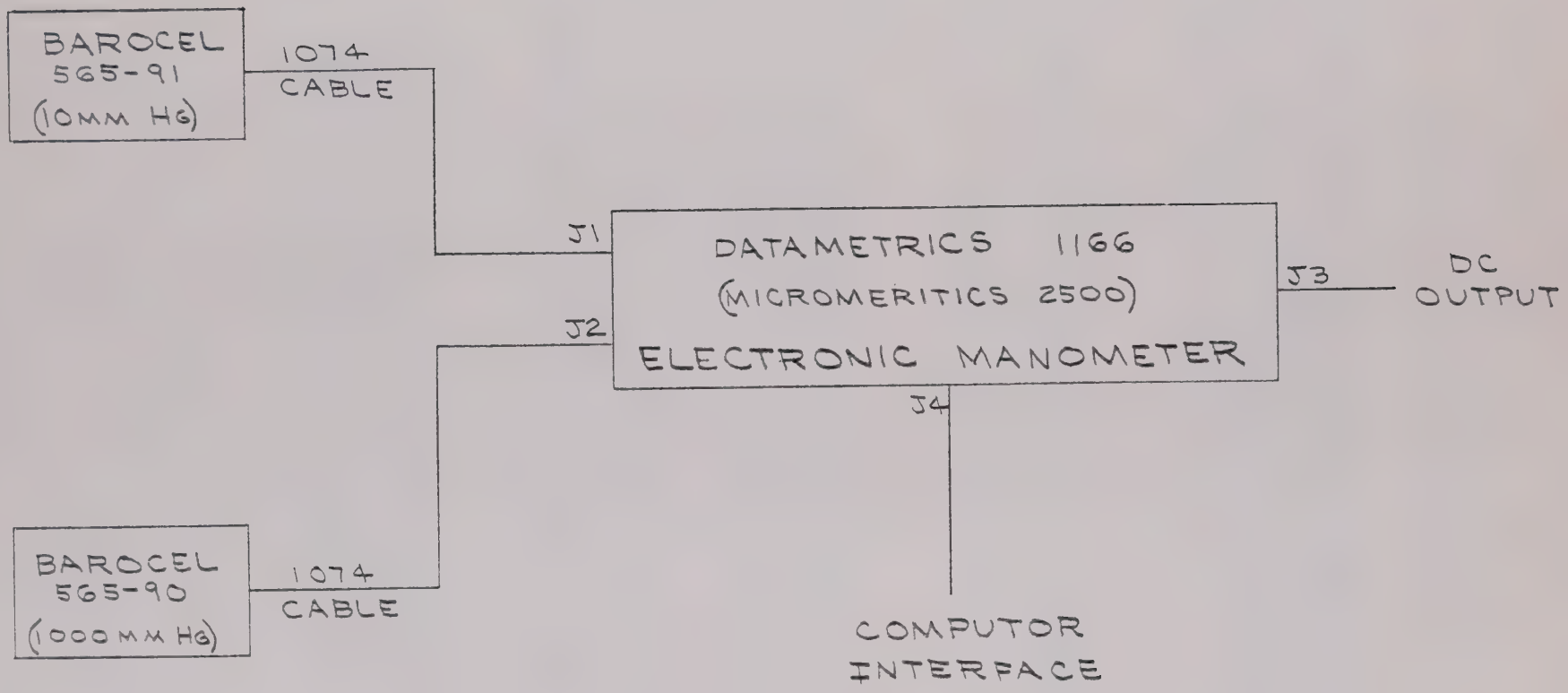
This selector switch enables the operator to determine which pressure sensor will be connected to the electronics.

Note: For computor control of the manometer, both the HEAD SELECTOR and the RANGE MULTIPLIER must be set to the "computer select" position.

ZERO Controls (Front Panel)

For the particular transducer being used, electrical zero read-out on its two ranges can be guaranteed for zero pressure using the ZERO Control.

CAL (screwdriver adjustable pots on front panel.



CONNECTION DIAGRAM

1166 ELECTRONIC MANOMETER

This control, one for each transducer, allows the user to calibrate the electronic circuitry for correct operation. Specifically, when the CAL pushbutton on the transducer is depressed, with the RANGE MULTIPLIER in the x1 range for the respective transducer, adjustment of this control allows the d.c. output to be the CAL number that appears on the transducer label, as a percentage of 1.0VDC.

OPERATING INSTRUCTIONS

No adjustments are to be made to any pots or components other than those which can be accessed from the front panel.

DO NOT UNDER ANY CIRCUMSTANCES MAKE ADJUSTMENTS TO ANY RESISTORS.

Power Input

The Electronic Manometer system is placed into operation by attaching the interconnecting cables and energizing the Electronic Manometer with primary power. Approximately two hours warm-up time is required for operation. If the instrument is to be used daily, it should be checked to insure that it is within specified line voltages.

RANGE MULITIPLIER and HEAD SELECTOR Switches

The sensitivity of the system and the choice of pressure sensors is determined by means of the front panel switches.

NULL

Initially, apply power and turn the RANGE MULTIPLIER Switch to NULL. The electrical output corresponds to zero pressure differential input. Recorders, voltmeters, or data logging equipment can then be zero adjusted. Note that in this position, the output is independent of pressure input and ZERO adjustments.

ZERO

The need to adjust ZERO will depend on the accuracy required, the environment of the transducer, and the operating history of the transducer.

Differential Pressure Models: Both pressure ports are valved together with the approximate line pressure at which operation is planned (that is, with zero differential pressure existing between the parts). The ZERO is set for zero output with the RANGE MULTIPLIER switch in the most sensitive position.

For absolute barocels (self-contained vacuum referenced models), ZERO is set for zero dc output when connected to a vacuum source which will produce a pressure at the input of the transducer at least 10 times lower than the maximum tolerable error desired when operating the system.

DC OUTPUT

DC output occurs for full scale meter readout on any position of the RANGE MULTIPLIER Switch. DC output is 1 volt. The output impedance is less than 0.1 ohms.

Calibration Adjustment (CAL)

This adjustment is used to calibrate the complete system through electronics. Two methods are available. The first depends upon using a known pressure reference and adjusting the CAL pots until the output reads the correct value. The second method can be used where a CAL button has been provided on the barocel. Here, a known signal is injected into the barocel electronics to simulate a certain pressure; the CAL control is then adjusted for the correct output reading, as shown on the barocel, as a percentage of Full Scale Output.

Input/Output Connectors

1. The AC power is connected to the unit by means of the included 3rd wire grounded plug. For safety reasons, this provision should not be defeated.

2. The Connection between the transducers and manometer is made with a Datametrics type 1074 cable provided with the unit. It is important in the installation that the cable shield not come into contact with ground in any way. An unwanted ground on the cable shield could result in ground loop problems causing erroneous results especially at low pressure.

3. DC output is obtained with a standard BNC cable connector.

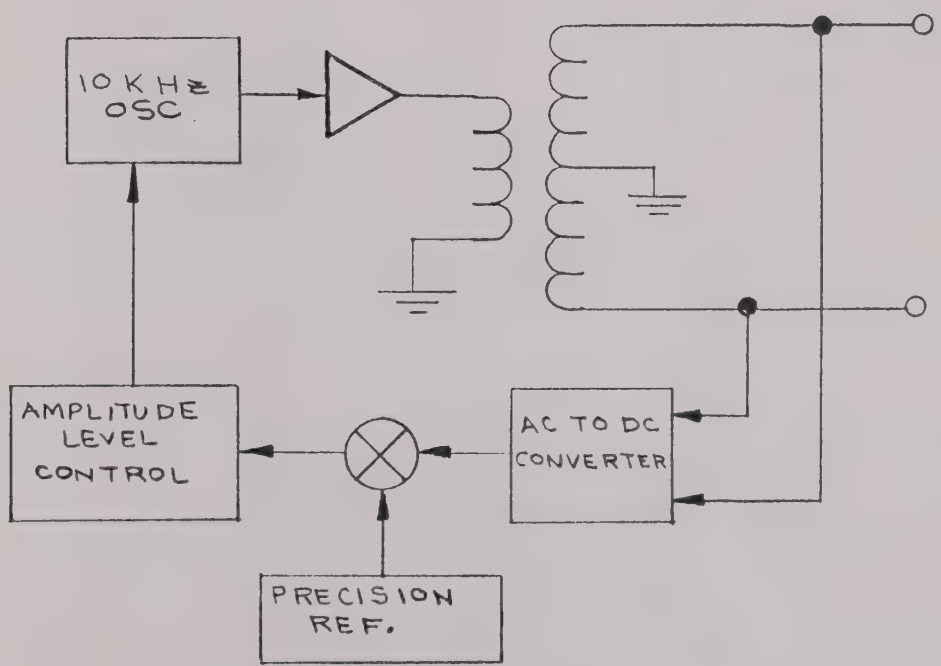
4. Computer Interface is obtained through J4.

BASIC SYSTEM

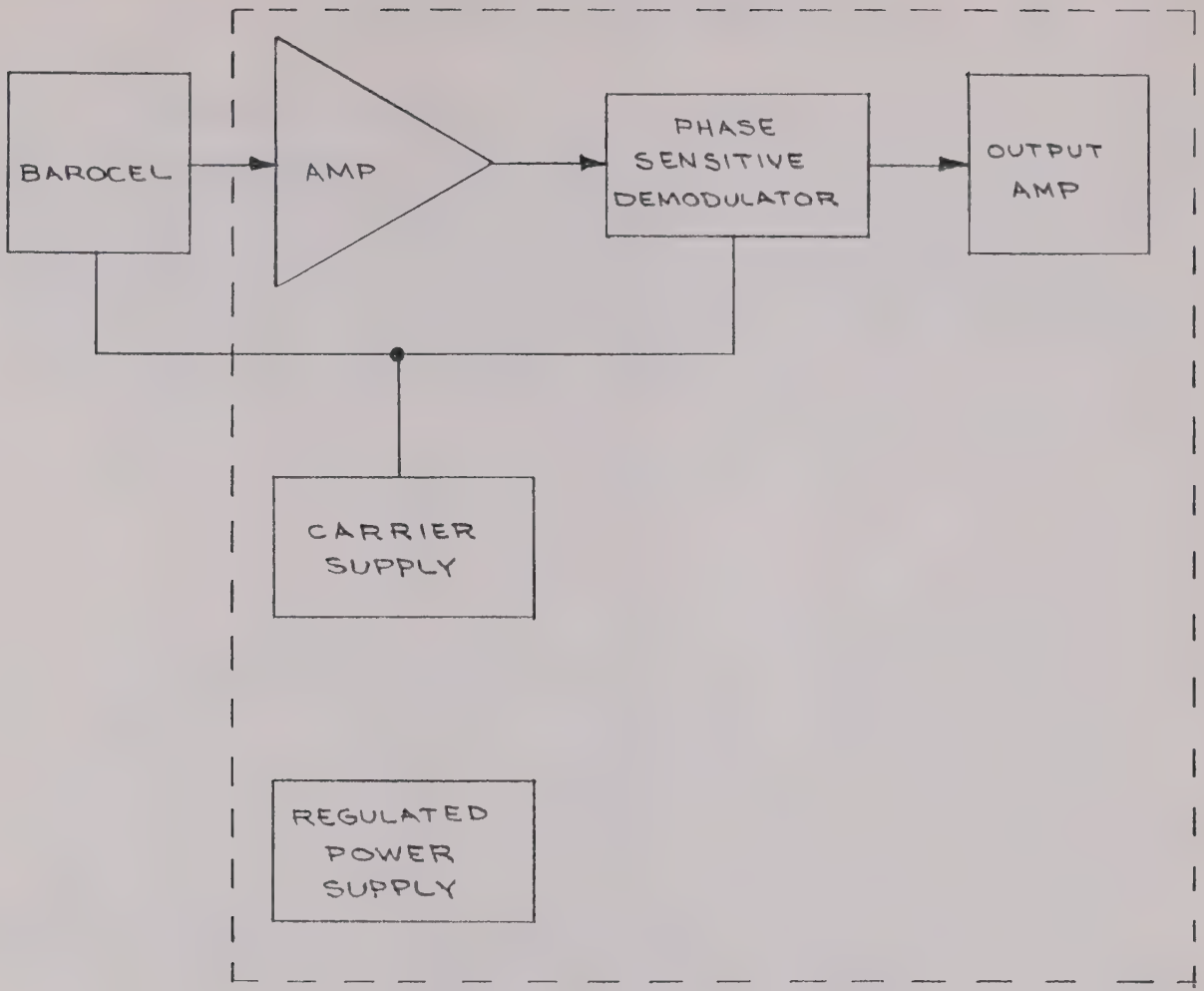
Contained within the Electronic Manometer circuit board are the 10 KHz carrier supply, stablized DC power, the signal range switch and amplifier, the phase sensitive demodulator, and output amplifier, as shown in Figure 1. In addition, the autoranging board and logic boards are also contained in the Manometer.

CARRIER POWER SUPPLY

The 10 KHz power supply provides excitation for the Barocel pressure sensors and drive for the phase sensitive detector. The Carrier Supply has an extremely precise closed loop automatic amplitude leveling control such that the carrier amplitude is immune to power line voltage variations and normal room temperature changes.



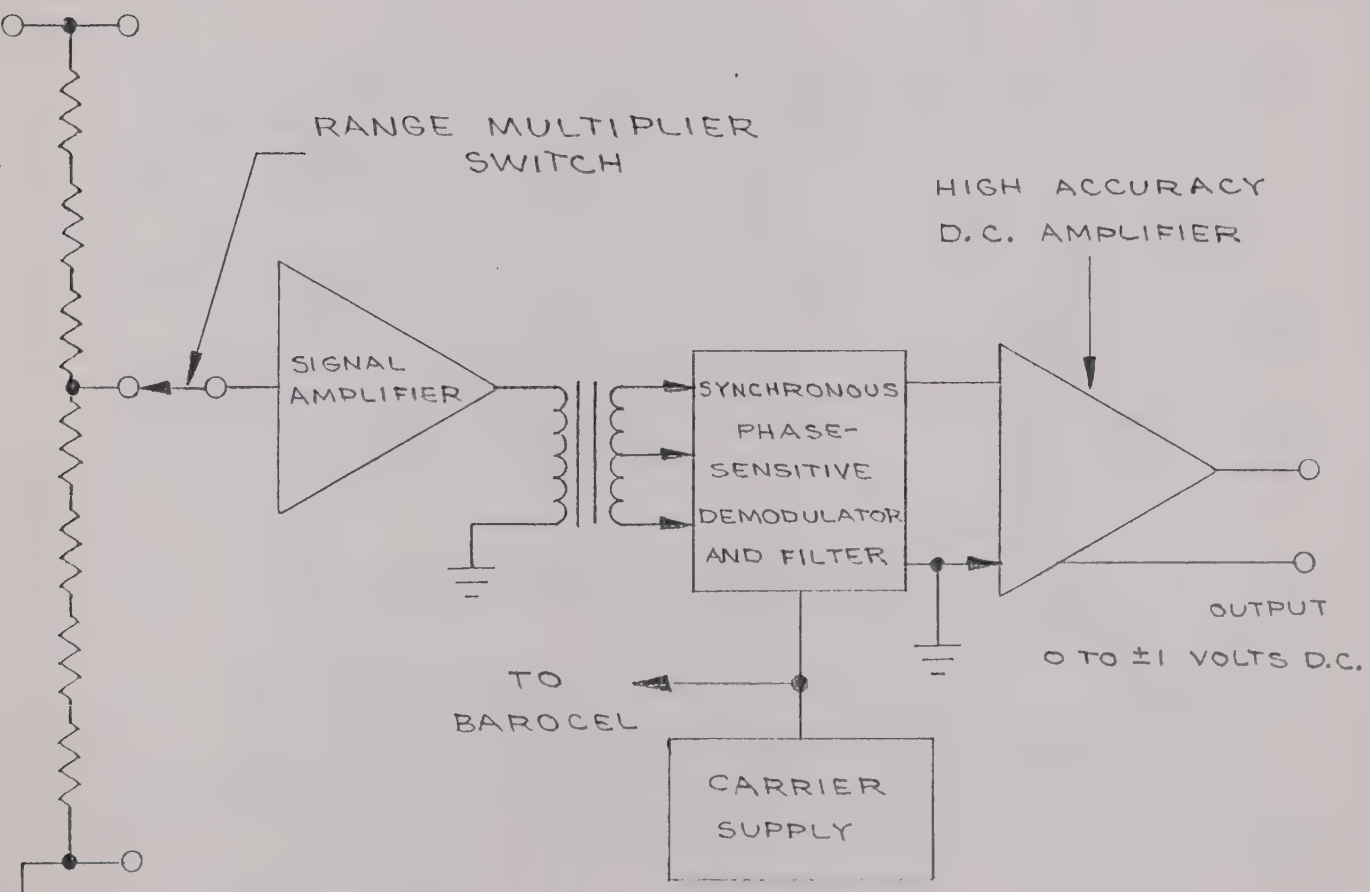
CARRIER SUPPLY



SYSTEM BLOCK DIAGRAM

SIGNAL CONDITIONING CHANNEL

In order to take advantage of the excellent fractional accuracy of the pressure sensor, the amplitude modulated 10 KHz signal of the pressure sensor is fed into a signal conditioning channel consisting of a high gain amplifier preceded by a high precision, calibrated voltage attenuator which makes up the RANGE MULTIPLIER Switch. In this unit, the RANGE MULTIPLIER switching is physically accomplished using field effect transistors.



SIGNAL CONDITIONER

The resistors in the voltage attenuator are of low temperature coefficient and of high accuracy such that the slope error in switching from range to range is less than 0.05%, thereby eliminating the need for calibration when range switching.

In the ZERO position of the RANGE MULTIPLIER Switch, the input to the amplifier is grounded, simulating zero.

The signal amplifier is of high internal gain with heavy feedback for gain stability. There are controls within the amplifier which affect balancing, quadrature, and sensitivity adjustments of the Barocel Pressure Sensor even though the Sensor may be physically remote from the Electronic Manometer.

SYNCHRONOUS PHASE SENSITIVE DEMODULATOR

The Signal Amplifier feeds into a phase-sensitive detector to yield positive and negative outputs corresponding to the sign of applied pressure. The demodulator switches in phase synchronism with the carrier so that its output is the desired in-phase component to the barocel output. Electrical noise pick-up in the signal chain which is nonsynchronous with the carrier is automatically rejected. A special multiple transistor switching system is used rather than simple diodes to provide optimum linearity of the AC to DC conversion. A high degree of amplification is done prior to the demodulator because it is the most efficient place to achieve sensitivity without concern to zero drift in DC amplifiers. A low-gain high-precision DC output amplifier reduces the output impedance to less than 0.1 ohm so that external equipment does not affect the calibration.

DC SUPPLY

The DC Supply is regulated to prevent line voltage variations from affecting the pressure-generated signal in any way.

DETAILED CIRCUIT DESCRIPTION

The basic 1166 Barocel Electronic Manometer is divided into two sub-assemblies: the chassis wiring, and the manometer circuit board.

1. System Schematic (D3807-70101)

   The chassis wiring gives the user an insight into the overall system previously discussed.

2. Manometer (J3807-70103)

   a. The pressure sensor selector is done with FET's Q_1 and Q_2.

FET's Q_{36} and Q_{37} short out the signal from the sensor, not selected.

b. The range switching is done by FET's Q_3 through Q_7. The precision voltage attenuator is composed of R_{71} through R_{73}.

c. The FET drivers are pnp-npn transistor pairs, of which Q_8 and Q_9 comprise a pair. This circuit translates the TTL logic voltage levels to those required by the FET switches.

d. Input Amplifier: The signal from the FET Range Switch is applied to amplifier A_4. The gain of the stage is determined by R_{76}, R_3, R_{77} and R_{78}. The amplifier stage itself is an externally compensated integrated circuit that was chosen for its high open-loop gain capabilities at the carrier frequency.

e. Balanced Demodulator: The signal is then applied through transformer T_3 to the phase demodulator comprising FET's Q_{32} and Q_{33}. The FET's are alternately turned on and off in synchronism with the carrier frequency. Transistor stages Q_{30} and Q_{31} provide the necessary drive to the demodulator FET's.

f. Output Amplifier: The demodulated signal (i.e. the DC voltage proportional to transducer pressure) is filtered by L_1, C_{28}, C_{29}, C_{30}, and C_{27} to remove any harmonics of the carrier frequency, as well as noise superimposed on the pressure system. Amplifier A_1 is used to provide a low output impedance DC voltage proportional to pressure.

g. Carrier Supply: Amplifier A_2 and associated circuitry comprise the carrier supply. Integrated circuit A_2 functions as a Wein bridge oscillator with feedback accomplished with the voltage-controlled resistor, FET Q_{26}. This type of oscillator is capable of yielding the low distortion carrier required in this application. Transistors Q_{25} and Q_{29} function as a complementary push-pull amplifier for driving the two barocel transducers through transformer T_2. Potentiometer R_{123} provides adjustment for injecting a small signal to enable zero adjustments of the amplifier.

h. Power Supply: Integrated circuit A_3 and associated components provide the well-regulated voltages for the unit. The supply is short circuit protected for improved reliability.

i. Logic Circuitry: Digital logic circuitry A_1 thru A_7 enable interfacing the manometer with an external computer for sensor and range determination. All connections for this operating mode are made through J4, the interface connector.

SECTION V - MAINTENANCE AND TROUBLE-SHOOTING

The factory should be called any time a problem with the equipment is suspected, particularly if any part of it is to be sent back.

When tracking a suspected problem with an Electronic Manometer System, it is advantageous to consider the three parts separately, the readout, the sensor, and the interconnecting cables.

READOUT

A large portion of the Electronic Manometer readout can be checked by noting the output in the ZERO position. ZERO should be zero (0.0000 volts).

If an incorrect CAL reading is obtained and the CAL adjustment will not correct it, then the factory should be contacted.

SENSOR

If the readout is correct in NULL and F.S., then the ZERO should be checked on the lower range.

SOME SYMPTONS	POSSIBLE CAUSES
1. ZERO will not zero with zero pressure.	1. Leaks in tubulation or joints Dirt in cell.
2. Large zero drift with time.	2. Moisture condensing, then drying.
3. Change in zero from range to range with zero delta pressure on cell.	3. Moisture in cell.
4. Large scale factor errors (as determined by pressure standard.	4. Dirt in cell.
5. Apparent zero drift after large pressure.	5. "Creep-back" of the diaphragm.
6. No output with applied pressure.	6. Leak in couplings Short or open circuit in cabling.

NOTES

1. Moisture in the cell may be drawn out with vacuum (300μ or less) for 20 minutes or driven out with moderate heat (125°F).

2. Dirt in the cell can be cleaned only at the factory.

NOTES cont.

3. Look for leaks by isolating various portions of the tubing and observing the pressure change with the Electronic Manometer. In vacuum systems, consideration should be given to gassing of the cell and leakage through "0" rings, if any.

CABLES

The cables can be checked in either of two ways. Connect the suspected cables between a properly functioning manometer and sensor and check readings. Disconnect cables, check for fraying or short circuits, and check with an ohmmeter.

FACTORY RETURNS

If the unit is to be returned to the factory, the following procedures should be followed to expedite matters:

1. If a sensor is to be returned, carefully cover the parts to keep packing material out of the cell.

2. Pack the unit carefully with a great amount of shock-absorbing material. Preferably use the original packing case.

3. Enclose with the unit a brief description of the symptoms observed. This will greatly expedite the return of the unit.

4. The package can be sent via Parcel Post, Air Freight, or any other standard transportation, according to your requirements. Boat shipments should have normal salt spray protection. Return to factory must be prepaid. Collect shipments are not accepted.

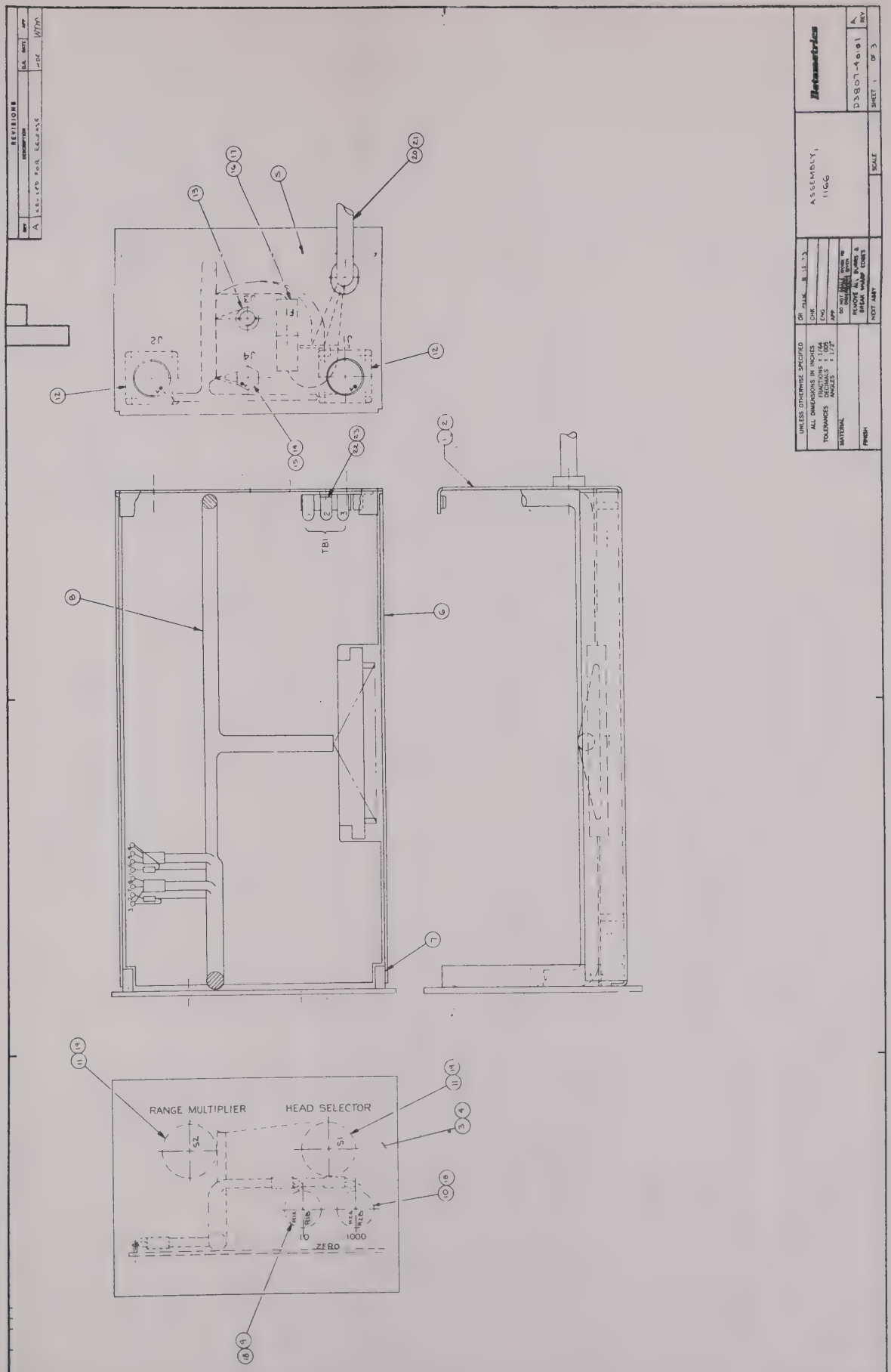
SECTION VI - SPARE PARTS

When requesting spare parts, the serial number on the unit must be submitted. Parts other than those specified on the Spare Parts List MUST BE REPLACED AT THE FACTORY.

Item #	Symbol	Description	Manufacturer	Part #	Total in unit
1	A1	PC BD Assembly	Datametrics	3807-40105	1
2	F1	Fuse, 1/4A SB	Buss	1/4A SB	1

SECTION VII - DRAWING AND PARTS LIST

TITLE	NUMBER
1166 Assembly	PL/D 3807-40101
1166 Schematic	D 3807-70101
PC BD Assembly	PL/D 3807-40105
PC BB Schematic	J 3807-70105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DESCRIPTION
A REVISED FOR RELEASE
Datametrics
ASSEMBLY, 11166
D3807-4001
A
SHEET 1 OF 3
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS IN INCHES
FRACTIONS ± 1/64
DECIMALS ± .005
ANGLES ± 1/2°
TOLERANCES
MATERIAL
FINISH
DO NOT SCALE DRAWING
REMOVE ALL BURRS & SHARP EDGES
NEXT ASSY
J2
J4
J5
TB1
RANGE MULTIPLIER
HEAD SELECTOR
S2
S1
10
1000
ZERO

REV	DATE	ECO NO.
A	—	—
B	7-29-75	ECO # 642

Datametrics

TITLE & NO.

TYPE 1166
MANOMETER
ASSEMBLY

PREPARED BY MDR 10-18-73

CHECKED BY 7-31-75

ENGR.

APP'D. 7/31/75

ASSEM. DWG SIZE D

LIST NUMBER REV
PL. 3807-40101

SHEET 2 OF 3

SCHEMATIC NO.
D3807-70101

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
1		CHASSIS, MACH.	DATAMETRICS	D3807-10102	1			
2		CHASSIS, MARKING		D3807-20102	1			
3	*	FRONT PANEL, MACH.		C3807-10101	1			
4	*	FRONT PANEL, MARKING		C3807-20101	1			
5	A1	PC BD ASSEMBLY		PL/D3807-40105	1			
6		COVER		D3807-10103	1			
7		CORNER POST		B3807-10104	2			
8		CABLE HARNESS	DATAMETRICS	D3807-50101	1			
9	R1A R1B	POTENTIOMETER, ZERO 10	DATAMETRICS	AC11063	1			
10	R2A R2B	POTENTIOMETER, ZERO 1000	DATAMETRICS	AC11063	1			
11	S1,2	SWITCH, ROTARY	CENTRALAB	PA-2001	2			
12	J1,2	CONNECTOR	AMPHENOL	MS3102A-16S-1SW	2			
13	J3	CONNECTOR, BNC	AMPHENOL	UG657/U-1050	1			
14	J4	CONNECTOR, 7 PIN	AMPHENOL	126-197	1			
15	P4	CONNECTOR, CABLE MOUNTED	AMPHENOL	126-196	1			
16	F1	FUSE	BUSS	1/4 AMP SLO BLO	1			

* MICROMETRICS TO SUPPLY

REV	DATE	ECO NO.

Datametrics

TITLE & NO. TYPE 1166 MANOMETER ASSEMBLY

PREPARED BY MDR 10-18-73

ENGR. WTM

CHECKED BY MDR 7-31-75

APP'D. 7/31/75

ASSEM.DWG. SIZE D

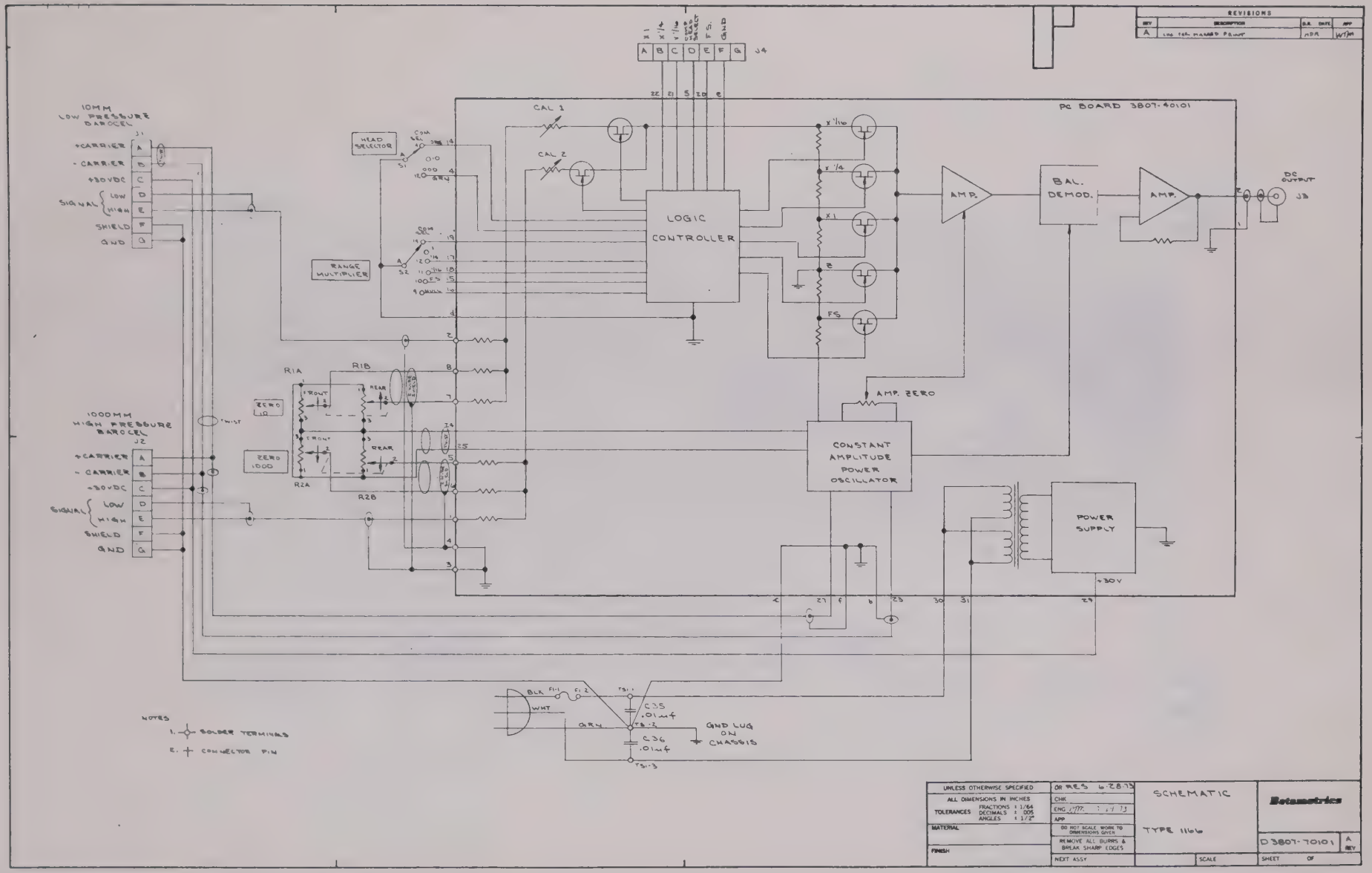
LIST NUMBER REV PL.3807-40101

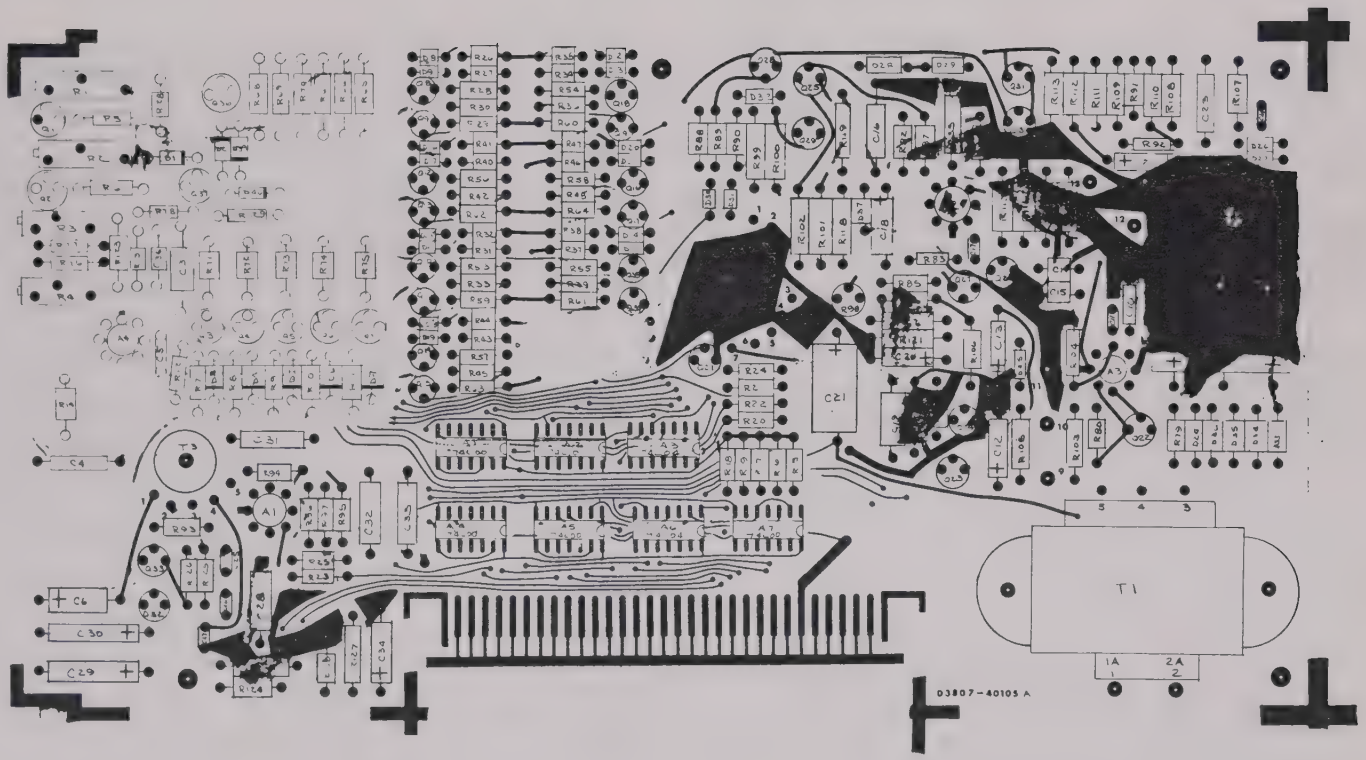
SHEET 3 OF 3

SCHEMATIC NO. D3807-70101

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
17	XF1	FUSE BLOCK	BUSS	4405	1			
18		KNOB	KURZ-KASCH	S-1747-3L	2			
19		KNOB	KURZ-KASCH	S-1647-3L	2			
20		LINE CORD	BELDEN	17409B	1			
21		STRAIN RELIEF	HEYCO	GP-4	1			
22	TS1	TERMINAL STRIP	H.H.SMITH	864	1			
23	C35,36	CAPACITOR, .01 mf	CENTRALAB	GP110	2			
24		SPACER 1/4 OD x 1/2 LG #4	HH SMITH	3483	5			
25								
26	P1, P2	CONNECTOR	AMPHENOL	3106A-16S-1PW	2			
27								
28								
29								
30								
31								
32								


REVISIONS
REV
DESCRIPTION
DR. DATE
APP
A
INC TEK MANNED PRINT
MDR
WTM
PC BOARD 3807-40101
10MM
LOW PRESSURE
BAROCEL
J1
+CARRIER
-CARRIER
+30VDC
SIGNAL
LOW
HIGH
SHIELD
GND
1000MM
HIGH PRESSURE
BAROCEL
J2
HEAD SELECTOR
RANGE MULTIPLIER
CAL 1
CAL 2
LOGIC
CONTROLLER
AMP.
BAL.
DEMOD.
AMP.
DC
OUTPUT
J3
J4
AMP. ZERO
CONSTANT
AMPLITUDE
POWER
OSCILLATOR
POWER
SUPPLY
+30 V
R1A
R1B
R2A
R2B
ZERO
1X
ZERO
1000
TWIST
FRONT
REAR
NOTES
1. SOLDER TERMINALS
2. CONNECTOR PIN
BLK
WHT
GRN
C35
.01 mf
C36
.01 mf
GND LUG
ON
CHASSIS
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS IN INCHES
TOLERANCES
FRACTIONS ± 1/64
DECIMALS ± .005
ANGLES ± 1/2°
MATERIAL
FINISH
DO NOT SCALE WORK TO DIMENSIONS GIVEN
REMOVE ALL BURRS & BREAK SHARP EDGES
NEXT ASSY
CHK
ENG
APP
SCHEMATIC
TYPE 1166
Data-metrics
D3807-70101
A
REV
SCALE
SHEET
OF



MATL	FINISH	BY	DATE	DATAMETRICS
		DR RES	12-6-72	
UNLESS OTHERWISE SPECIFIED		CHK		TITLE ASSEMBLY PC BOARD
FRACTIONS ± 64		ENG		TYPE - 1166
DECIMALS .003		PROD		
ANGLES ± 30				SCALE DWG NO REV
REMOVE BURRS NO SHARP EDGES				DO NOT SCALE PRINT D 3807 40105 A

REV	DATE	ECO NO.
B	6-25-74	ECO # 421
C	1-2-75	ECO # 486
D	7-29-75	ECO # 642

Datametrics

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FJ 11-30-72

CHECKED BY MDR 7-31-75

ENGR. WTM

APP'D.

ASSEM. DWG. SIZE D

LIST NUMBER REV
PL. 3807-40105 D

SHEET 2 OF 9

SCHEMATIC NO.
J3807-70105 D

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
1		PC BD MACH	DATAMETRICS	D3807-10105 D	1			
2	C13	CAPACITOR, 100uf, 25V	SPRAGUE	TVA-1207	1			
3	C 3,4, 16,23,28	CAPACITOR 0.1 Uf, 80V	SPRAGUE	192P1049R8	5			
4	C31,32,33, 35	0.1 Uf, 80V	SPRAGUE	192P1049R8	4			
5	C5	15 Pf	ELMENCO	DM15	1			
6	C6,12, 18,19,20	15 Uf, 20V	SPRAGUE	150D156X9020B2	5			
7								
8	C10	6.8 Uf, 6V	SPRAGUE	150D685X9006A2	1			
9	C11	47 Pf	ERIE	CK05CW470K	1			
10	C14,15,22	1000 Pf 5%	ELMENCO	DM15	3			
11	C17	3300 PF	ERIE	CK06CW332K	1			
12	C21	120 Uf, 15V	SPRAGUE	150D127X9015S2	1			
13	C24	330 PF	ERIE	CK05CW331K	1			
14	C25,26,	1000 PF	ERIE	CK05CW102K	2			
15	C27	470 PF	ERIE	CK05CW471K	1			
16	C29,30	CAPACITOR 47 Uf, 6V	SPRAGUE	150D187X9006R2	2			

REV	DATE	ECO NO.

Datametrics

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FJ 11-30-72

CHECKED BY

ENGR.

APP'D.

ASSEM.DWG. SIZE D

LIST NUMBER REV
PL. 3807-40105

SHEET 3 OF 9

SCHEMATIC NO.
J3807-70105

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
17	C34	CAPACITOR 39 Mf, 10V	SPRAGUE	150D 396X9010B2	1			
18	C36	CAPACITOR, 100pf	ERIE	CK05CW101K	1			
19	C37	CAPACITOR, 220pf	ERIE	CK05CW221K	1			
20	C7	CAPACITOR, 500mF, 50V	SPRAGUE	TVA 1315	1			
21	C8,9	CAPACITOR, 100mF, 50V	SPRAGUE	TVA 1310	2			
22	R134	POTENTIOMETER, 100Ω	BOURNS	3305P-100Ω	1			
23	R133	POTENTIOMETER, 2K	BOURNS	3305P-2K	1			
24	R1, 2	POTENTIOMETER, 2K	HELITRIM	78PR2K ONLY	2			
25	R3	POTENTIOMETER, 100Ω	HELITRIM	79PR100Ω ONLY	1			
26	R4	POTENTIOMETER, 25K	HELITRIN	79PR25K ONLY	1			
27	RS-11 128, 129	RESISTOR, 1M, 1/4W, 5%			9			
28	R12, 14, 79 84, 94-96	87 100Ω, 1/4W, 5%			8			
29	R13	1.5K 1/4W, 5%			1			
30	R15-25, 92 89	4.7K, 1/4W, 5%			13			
31	R26, 27 30-48	3.3K, 1/4W 5%			21			
32	R29, 59-64,	RESISTOR, 47K, 1/4W, 5%			7			

REV	DATE	ECO NO.

Datametrics

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FR 11-30-72

CHECKED BY

ENGR.

APP'D.

ASSEM.DWG SIZE D

LIST NUMBER REV PL.3807-40105

SHEET 4 OF 9

SCHEMATIC NO. J3807-70105

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
33	R28 R53-58	RESISTOR 12K, 1/4W 5%			7			
34	R69 R65	100K, 1%		RN60C	2			
35	R66,70	1M 1%		RN60C	2			
36	R67,68	1K, 0.1%, WW		SA30	2			
37	R123	24.3K 1%		RN60C	1			
38	R71	20K, 0.1%, WW		SA30	1			
39	R72	5050Ω 0.1%, WW		SA30	1			
40	R73	1.8K 0.1%, WW		SA30	1			
41	R74	100 0.1%, WW		SA30	1			
42	R75	12.4K 0.1% WW		SA30	1			
43	R76	21K 1%		RN60C	1			
44	R77	866Ω 1%		RN60C	1			
45	R78	1Ω 1%		ELIA	1			
46	R80	1Ω 1%		ELIA	1			
47	R81	18K, 1/4W, 5%			1			
48	R82	RESISTOR 100Ω, 1%		RN60C	1			

REV	DATE	ECO NO.

Datametrics

ASSEM. DWG SIZE D

LIST NUMBER REV PL.3807-40105

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FR 11-30-72

ENGR.

SHEET 5 OF 9

SCHEMATIC NO. J3807-70105

CHECKED BY

APP'D.

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
49	R83,86, 91	RESISTOR, 1K, 1/4W, 5%			3			
50	R85	150K, 1/4W, 5%			1			
51	R88	68K, 1/4W, 5%			1			
52	R90	470Ω, 1/4W, 5%			1			
53	R93	10K, 1/4W, 5%			1			
54	R97	RESISTOR, 8.2Ω, 1/4W, 5%			1			
55	R98	POTENTIOMETER, 1K	BOURNS	3305-1-102M	1			
56	R99,102	RESISTOR, 3.3, 1/2W, 5%			2			
57	R103	16.5K, 1%		RN60C	1			
58	R104	2260Ω, 1%		RN60C	1			
59	R105	4990Ω, 1%		RN60C	1			
60	R106	4750Ω, 1%		RN60C	1			
61	R107	5110Ω, 1%		RN60C	1			
62	R108,112	22.1K, 1%		RN60C	2			
63	R109-111, 113	10K 1%		RN60C	4			
64	R114,116	RESISTOR 16.2K 1%		RN60C	2			

REV	DATE	ECO NO.

Datametrics

ASSEM.DWG. SIZE D

LIST NUMBER REV PL.3807-40105

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FG 11-30-72

ENGR.

CHECKED BY

APP'D.

SHEET 6 OF 9

SCHEMATIC NO. J3807-70105

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
65	R115	RESISTOR, 38.3K, 1%		RN60C	1			
66	R117	18.2K, 1%		RN60C	1			
67	R118	2 K, 1%		RN60C	1			
68	R119	374Ω, 1%		RN60C	1			
69	R120	3.4K, 1%		RN60C	1			
70	R121	47.5K, 1%		RN60C	1			
71	R122	2670, 1%		RN60C	1			
72	R124	6.81K 1%		RN60C	1			
73	R125,126	10M, 1/4W 10%			2			
74	R127	RESISTOR, 470Ω, 2W 5%			1			
75	R130 R131	RESISTOR, 53.6K, 1%		RN60C	2			
76	R132	RESISTOR, 1M, 1%		RN60C	1			
77	R100 R101	RESISTOR, 4.7Ω, 1/2W, 5%			2			
78								
79								
80								

REV	DATE	ECO NO.

Datametrics

ASSEM. DWG. SIZE D

LIST NUMBER REV PL.3807-40105

TITLE & NO.

P C BOARD ASSEMBLY
TYPE 1166

PREPARED BY FB 11-30-72

ENGR.

SHEET 7 OF 9

CHECKED BY

APP'D.

SCHEMATIC NO. J3807-70105

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
81	D1-21 D24-32 D39 40	DIODE		IN4148	32			
82	D33-36	DIODE		IN4004	4			
83	D37	DIODE		IN944	1			
84	D38	DIODE, ZENER		IN751A	1			
85								
86								
87								
88		HEATSINK	IERC	TXBF-032-025B	2			
89	Q1-7,32, 33,36,37	TRANSISTOR, FET		1898E	11			
90	Q8,10,12, 14,16,18			2N2907	6			
91	Q9,24, 27,28,35			2N2907	4			
92	Q9,11,13,15 17,19,			2N956	6			
93	Q30, 31, 34			2N956	3			
94	Q22,23, 25			2N4037	3			
95	Q26			E103	1			
96	Q29	TRANSISTOR		2N3053	1			

REV	DATE	ECO NO.

Datametrics

ASSEM. DWG. SIZE D

LIST NUMBER REV PL.3807-40105

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FB 11-30-72

ENGR.

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APP'D.

SHEET 8 OF 9

SCHEMATIC NO. J3807-70105

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
97								
98								
99								
100								
101								
102								
103	A9	AMPLIFIER	NSC	LM207H	1			
104	A10	MC1439 G	DATAMETRICS	A12784	1			
105	A8		NSC	LM305H	1			
106	A11	U709C	FAIRCHILD	709HC	1			
107	A2		TI	SN74L10	1			
108	A3 A6		TI	SN74L04	2			
109	A1, 4 5, 7	AMPLIFIER	TI	SN74L00	4			
110								
111								
112	L1	INDUCTOR 10MH, CHOKE	DINK	10,000	1			

REV	DATE	ECO NO.

Datametrics

ASSEM. DWG. SIZE D

LIST NUMBER REV
PL. 3807-40105

TITLE & NO.

PC BOARD ASSEMBLY
TYPE 1166

PREPARED BY FH 11-30-72

ENGR.

SHEET 9 OF 9

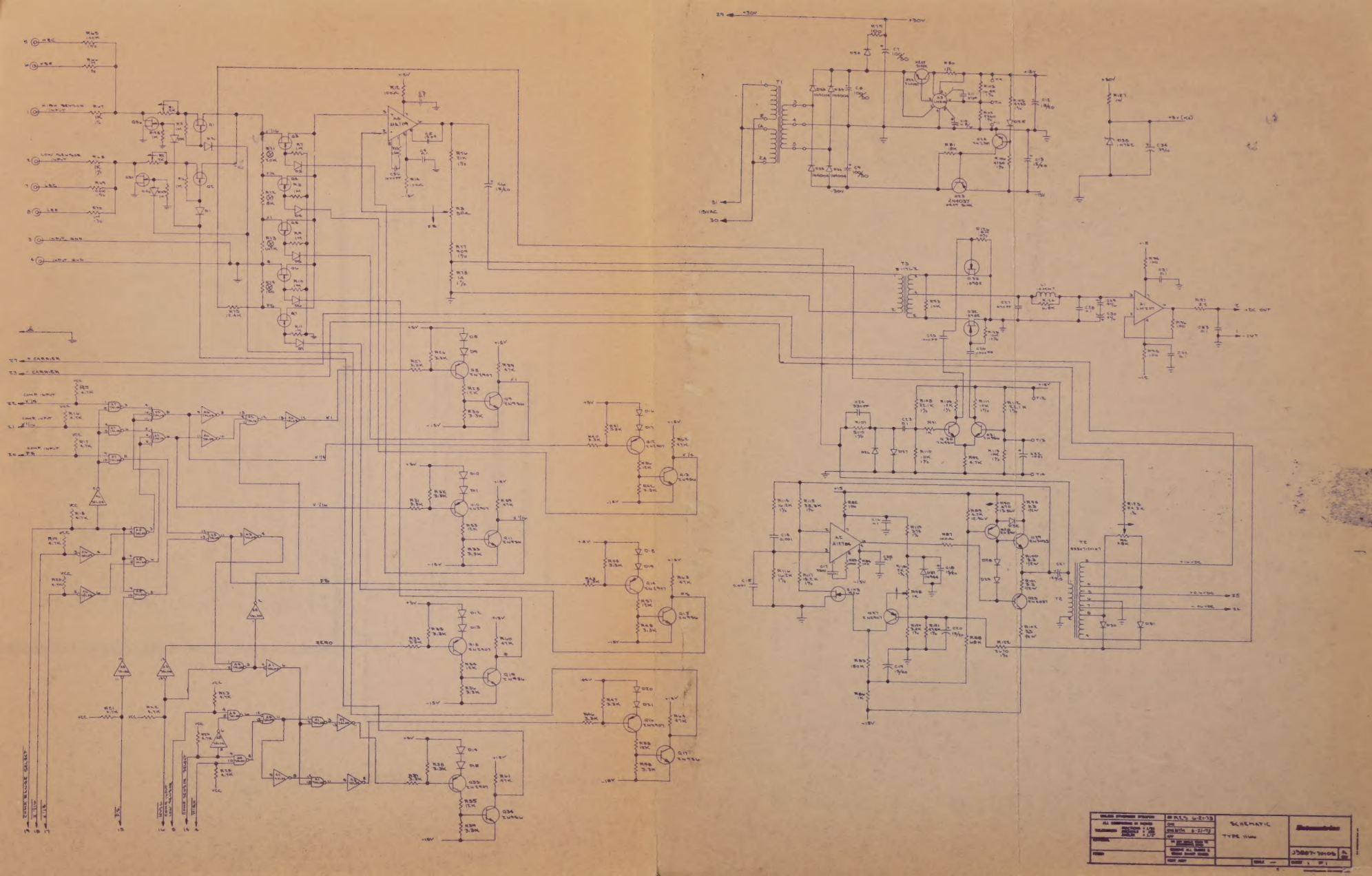
SCHEMATIC NO.
J3807-70105

CHECKED BY

APP'D.

CONTRACT NO.

ITEM NO.	SYMBOL NO.	DESCRIPTION	MANUFACTURER	MANUFACTURER NO.	G1	G2	G3	G4
113								
114								
115								
116								
117	XF1	TRANSFORMER	DATAMETRICS	B13572	1			
118	XF2	TRANSFORMER	DATAMETRICS	B3807-10107	1			
119	XF3	TRANSFORMER	DATAMETRICS	B11762	1			
120								
121								
122		SPACER, HELITRIM	DATAMETRICS	C3807-10106	REF.			
123		TERMINAL	CTC	1558-2	14			
124		SOCKET, 14 PIN	SCAUBE	C931402	7			
125								
126								
127								
128					-			



DATAMETRICS

Warranty

Datametrics warrants equipment of its own design and manufacture to be free from defects in material and workmanship under normal conditions of use and service. Datametrics will either repair or replace at our option any instrument found to be defective on its return to the place of manufacture within one year from the original date of shipment. Transportation charges must be prepaid.

This warranty carries no liability, either expressed or implied, beyond our obligations outlined above. This warranty is void if the product is subjected to misuse, accident, neglect or improper application, installation or operation.

NOTE: Specification and designs are subject to change without notice.

IMPORTANT

In order for the Warranty to be honored we request you fill out the enclosed mailing card, complete with end user name and address, plus equipment model number and serial number. Your compliance to our request will enable us to offer you better service with minimum delay and will place your name on our mailing list to receive future application notes and new product announcements.

Other interested parties may have their name placed on our mailing list by returning the extra card attached or by writing directly to the factory at the address below:

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